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Marine forensic arthropodology: the use of a baited camera to study carrion decomposition in the Saanich Inlet

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Forensic entomology is traditionally applied to terrestrial homicide cases in order to estimate elapsed time since death. However, many human bodies are recovered from the marine environment and the effects of aquatic submergence and the faunal colonization of the remains are little studied. These experiments were conducted to examine the effects of marine submergence on pig carcasses (*Sus scrofa*) as human models.

In the first set of experiments, three pig carcasses were submerged and tethered at a depth of 7.5 m in Howe Sound, off the coast of the Lower Mainland of BC and a further three carcasses were submerged and tethered at a depth of 15m. The carcasses were examined by divers from immediate submergence until the remains stage. The first experiment was conducted in May and was repeated in October. The carcasses progressed through typical decomposition stages and were colonized by marine arthropods. Species and decomposition rates were impacted by depth and season but also by sediment type. Carcasses that came to rest on sand were consumed more rapidly than those on rocks.

The second set of experiments were conducted using a baited camera on the seabed of the Saanich Inlet at 94 m. A single pig carcass was placed under the camera and observed several times a day. The remains were rapidly consumed by a variety of arthropods, in particular, crabs, shrimp, and lobsters. Dogfish were probably responsible for the initial strike, but did not consume the carcass. The carcass was much more rapidly depleted at this site than at the previous site. This work is ongoing.

Waiter, there's a wasp in my water! A survey of the aquatic Hymenoptera of the world

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A summary of the known species of aquatic Hymenoptera is presented. In total, 150 species from six superfamilies (11 families) are recognized as aquatic. This number is likely an underestimate because of lack of knowledge of host range and behaviour for most species. Exemplar aquatic species from the six superfamilies are discussed and compared as follows: *Caraphractus cinctus* (Chalcidoidea), *Psychopria hoguei* (Proctotrupoidea), *Tiphodytes gerriphagus* (Platygastroidea), *Agriotypus chaoi* (Ichneumonoidea), *Anoplius depressipes* (Vespoidea), and *Aspidogyrus strigosus* (Cynipoidea). Many aquatic species have relatively dense setae on the body and wings for holding a plastron of air, as well as elongate claws for clinging to the substrate, although these traits are not present in all aquatic species. Mapping of aquatic behaviour on a cladogram of the Hymenoptera superfamilies reveals that it is derived. It is estimated to have evolved independently at least fifty times within the order. Aquatic wasps occur in both lotic and lentic freshwater habitats, and four species of ants and one species of platygastroid are known to occur in marine intertidal zones. All freshwater species of Hymenoptera are parasitoids, parasitizing seven orders of insects as well as spiders. Aquatic parasitism likely evolved by transition from semi-aquatic parasitoids living around the water's surface.

Ten years after: history and current status of the 1992-1997 biological control releases of *Galerucella* beetles to control purple loosestrife, *Lythrum salicaria*, in Ontario

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In August 1992, the Biological Control Laboratory, University of Guelph, received shipments of three insect species imported to North America as classical biological control agents for the invasive wetland plant purple loosestrife, *Lythrum salicaria*. From 1992 to 1997, two species of Chrysomelid beetles, *Galerucella calmariensis* and *G. pusilla*, were released at 219 sites across Ontario. Approximately 320,000 individuals were released through this time period. In 2004 and 2005, monitoring tours were done to assess the results of these programs. Beetles were recovered at 90% of the original release sites and were providing some degree of control at 66% of these locations. Purple loosestrife was considered to be 'under control' at over 100 sites, with over 90% reductions in its coverage, biomass, and flowering, and with widespread replacement by other wetland species (e.g. cattails). Beetles have dispersed extensively from the original release sites and can now be found through all of the loosestrife-infested watersheds in southern Ontario. Although approximately equal numbers of each species of *Galerucella* beetles were released until 1996, *G. calmariensis* comprised over 90% of the 2,630 beetles collected in 2004, and were the only species found at many release sites originally initiated with *G. pusilla.*

Preparations for the arrival of West Nile virus - is BC ready?

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Since West Nile virus arrived in North America in 1999, it has spread to almost every continental US state as well as most provinces of Canada. WNv has yet to reach British Columbia and we can benefit from the experiences of affected jurisdictions. Are we ready for its imminent arrival? Highlights from preparations in the Lower mainland include:

On the plus side:

1. The main areas of WNv vector concern have been identified and mapped.
2. The GVRD has ensured that sampling protocols have been standardized.
3. Mosquito control treatments have been tested.
4. Communication and Response Plans have been drafted.

But against this:

1. Different municipalities have adopted different approaches and the level of response may be patchy.
2. Monitoring the effectiveness of mosquito control treatment is often neglected.
3. Private lands are generally not being treated.
4. Different Health Authorities are taking different stances.

Questions that remain are:

1. Will sufficient mosquito larval control be undertaken on private lands?
2. How significant are bird roosts and migration patterns of different birds?
3. Will the *Culex pipiens* complex turn out to include highly competent vectors?
4. How significant a WNv vector is *Aedes togoi*?
5. What will trigger an Official Order from the Health Authorities to treat with mosquito larvicide or adulticide?
6. How important are climatic factors – such as rainfall, snowpack, and temperature?
7. Does applying adulticides reduce the incidence of WNv?

In conclusion:

8. Experience from many other jurisdictions warns against complacency and underscores the need to respond preemptively to an outbreak.
9. Larval control from very early in the season is a key component of the most successful campaigns.
10. Keeping the public informed is essential.
11. Because of coordination between municipalities and three years' lead time, Brit-

ish Columbia is better placed to fight West Nile virus than most other previously affected jurisdictions.

A new species and genus of crawling water beetle (Coleoptera: Haliplidae) from China

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A small dark dorsoventrally flattened haliplid collected in Sichuan Province, China, is described based on a single female specimen. It has a broad head (interocular separation four times eyewidth) with non-protruding eyes. The pronotum is broad and almost parallel-sided with the areas lateral to the longitudinal plicae raised relative to the medial area. The elytra are nearly flat and parallel-sided with blunt obtuse apices. The legs are typical for a haliplid but have extremely reduced swimming setae. The venter is black; the epipleura narrow gradually with no externally visible notch at the point of contact with the anterolateral corner of the metacoxal plates. Possible synapomorphies for the current genera of Haliplidae are presented and are used to show that this beetle cannot be a member of *Peltodytes* or the *Haliplus* clade (including *Algophilus* and *Apteraliplus*). Although this species appears closest to *Brychius*, it also cannot be placed in that genus as it does not share several of the suggested synapomorphies of that group of species.

Water beetles (Coleoptera: Dytiscidae) south to north in Manitoba

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Disturbance and change are common phenomena of all aquatic ecosystems. Over the last few years, my students and I have conducted extensive studies within the province. In southern Manitoba, the driving factors behind the differing dytiscid communities found in boreal vs. prairie ecozone ponds are principally associated with the impacts of agriculture. In northern Manitoba, at Churchill, the fauna has changed by >10% since 2000. Various reasons for this change are explored suggesting that many more opportunities exist for further study.

Waterbug ecology

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Waterbugs include the Belostomatidae (toebiters), Corixidae (waterboatmen), Nepidae (water scorpions), Notonectidae (backswimmers), and Pleidae (pygmy backswimmers). All are predators, and more or less opportunistic feeders with a broad feeding niche.

While the prairie *Trichocorixa verticalis interiores* Sailer overwinters as an egg, most species pass the winter as adults. Typically, dispersal of flying adults occurs in the spring and fall. The lentic bugs seem to be able to colonize virtually all aquatic habitats, being attracted to shiny surfaces by their UV reflection.

Saline lakes and ponds occur in the grasslands and parklands of British Columbia and the prairies. Many waterbugs occur in these waterbodies, but species differ in their salinity tolerance. In general, species richness decreases with increase in salinity, although abundance tends to increase in higher salinities.

Most freshwater species live in a wide variety of habitat types, including bogs, fens, marshes, ponds (temporary and permanent), and often lotic environments (at least overwinter). They are habitat generalists and widely distributed. As a result, they have been able to adapt to the loss of wetlands on the prairies and elsewhere, utilizing man-made dugouts and other artificial locations, provided these have sufficient food resources. This high adaptability implies that they are unlikely to become vulnerable, threatened, or endangered owing to habitat degradation and loss. They are not at risk and are not of conservation concern in Canada.

In contrast, there are a few species of lentic waterbug that occur in and are confined to high salinity ponds and lakes. Laboratory experiments show that these can live, breed, and regulate their internal milieu in freshwater, even though most do not naturally breed in such habitats. Experiments with *Cenocorixa expleta* (Uhler) suggest that such saline species are confined to high salinities because these constitute enemy free space. They appear to be excluded from freshwater habitats by mite parasitism, but mites are absent in the most saline ponds and lakes.

Highly saline ponds and lakes are of limited occurrence in Canada, and are vulnerable to degradation and destruction. It is suggested that as a result, saline waterbugs and other saline insects could easily become at risk. Therefore such habitats are of conservation concern. Since they do not rank high in the vertebrate-dominated conservation agenda, entomologists should become proactive in this regard.

Entomology in environmental consulting: the role of aquatic invertebrates

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Entomology has applications in many areas of environmental consulting. Invertebrate studies may be components of Environmental Assessments for new projects, such as the development of hydroelectric facilities or coal and metals mines in BC.

Aquatic and terrestrial insects and other invertebrates are often useful indicators for monitoring environmental changes that may result from existing project operations (e.g., stream sedimentation related to industrial activities). Comparisons between invertebrate community data collected as part of baseline (pre-project) and operational studies are often important components of the on-going environmental effects monitoring programs for these projects.

Invertebrates are also useful in the ecological risk assessment process. Invertebrates are collected from an area of interest, in which chemicals of potential concern have been identified. Laboratory analysis provides the levels of chemicals in the samples and the resultant data are incorporated into food chain models, aiding in assessing the risks posed to receptor species (often birds and small mammals) that may ingest prey items from the area of interest.

In the consulting realm, entomologists employ their skills in study design and implementation, data analysis and interpretation, and invertebrate taxonomy, which is a skill that is currently in high demand in the field of aquatic environmental consulting.